



SECTIONALIZER BASED MICROCONTROLLER TRAINER DEVELOPMENT FOR DISTRIBUTION AND TRANSMISSION NETWORK PROTECTION

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ABSTRACT

The purpose of this research were (1) to develop Sectionalizer Based Microcontroller Trainer which completely with jobsheets and handouts, (2) to test the feasibility Sectionalizer Based Microcontroller Trainer. The developed sectionalizer microcontroller trainer were applied for Distribution and Transmission Course, Department of Electrical Engineering, Universitas Negeri Malang, Indonesia. This model of development trainer adapting ADDIE development model. In this development model of the process is not serially, but in each there is always an evaluation process which aims to improve the trainer made products. This development model consists of 5 steps: (1) analysis of the course requirements sectionalizer trainer Distribution and Transmission Systems; (2) the design of learning media such as trainers and jobsheet sectionalizer; (3) development sectionalizer trainers; (4) implementation sectionalizer trainer will be used in the course lesson Distribution and Transmission Systems. But before it is implemented, sectionalizer based microcontroller trainer first validated by expert lecturer; (5) evaluation. The result of implementation were on media expert, obtained a percentage of 82.85%. In the matter experts, obtained a percentage of 92.50%. In the field test instrument (student), obtained a percentage of 90.54%. It can be concluded that Sectionalizer Based Microcontroller Trainer were feasible to be used as a learning media.

KEYWORDS: Development, Sectionalizer, Trainer, Feasibility

INTRODUCTION:

Distribution network used to distribute electric power from the load center to the customer through medium voltage and low voltage power lines. Because of its function then the reliability becomes a very important factor, for that distribution network is equipped with a safety [7]. Disturbance of distribution network can be temporary and permanent. Temporary disturbance is a disturbance that can be lost immediately, either disappear by itself or by disconnecting the moment from disturbed part of voltage source. While permanent disturbance is a disturbance in which to discharge it requires corrective action to get rid of the cause of the disturbance [6].

One of the safety equipment distribution network disturbance to prevent and limit damage in distribution network, to public safety caused by disturbance, and to improve customer service continuity is Sectionalizer. Sectionalizer is a breaker that automatically discharge the disturbed section of network distribution, but doesn't break the current noise. The function of sectionalizer is to localize the disturbances contained in the main channel [6].

Based on the result of the observation that on the Distribution and Transmission course, Electrical Engineering, Universitas Negeri Malang, Indonesia there is no relevant learning media (trainer) especially on the subject of Network Manuevers. This is evidenced also from the quantitative data obtained questionnaire is 48.33% with invalid criteria. To support students in understanding the working principles how to operate sectionalizer required development of Sectionalizer Based Microcontroller Trainer (SBMT).

The specification of SBMT is three phase voltage input at the source side, three sectionalizer devices, equipped with an amperemeter, LCD, button for operation and lamp indicator.

MATERIALS AND METHODS:

This model of development trainer adapting ADDIE development model [3]. This development model consists of 5 steps such as: (1) analysis of requirements SBMT, (2) the design of learning media, (3) development SBMT with equipped with jobsheets and handouts, (4) implementation SBMT, (5) evaluation.

The feasibility of SBMT are known based on validation by expert lecturer as follows: (1) validation by media expert, (2) validation by matter expert, (3) field test (about 20 students) which has taken Distribution and Transmission course.

This study used implementation step to collect both quantitative and qualitative data. Quantitative data in this study was obtained from assessment of sectionalizer based microcontroller trainer, jobsheets and handouts. While qualitative data was obtained from opinion and suggestions about sectionalizer based microcontroller trainer, jobsheets and handouts where this data used for product revision at step evaluation.

The guidelines for decision making feasibility criteria refer to Sa'dun Akbar [1]. While as a basis for decision making revise SBMT used criteria of qualification assessment adapted from Akbar and Sriwijaya [2].

RESULTS AND DISCUSSION:

The product of SBMT were as follows: (1) the sectionalizer based microcontroller trainer. This trainer is a simulation of medium voltage distribution network protection equipment that is sectionalizer, whose working principle has been adapted to the working principle the real sectionalizer, (2) jobsheets sectionalizer based microcontroller. The jobsheets contains learning objectives, experiment guides, tasks and analytical questions that student must do while using SBMT, (3) handouts sectionalizer based microcontroller. The handouts contains any material about sectionalizer to support Distribution and Transmission learning. The product of SBMT can be seen in Figure 1.



Figure 1. The Product of Sectionalizer Based Microcontroller Trainer Completely With Jobsheets & Handouts

The quantitative data which represents the feasibility of product SBMT can be seen in Table 1.

Table 1. Quantitative Data of Implementation Result

Subject	TSEV	TSEV-max	Percentage (%)	Information
Media Expert	87	105	82.85%	Very Feasible
Matter Expert	74	80	92.50%	Very Feasible
Responden (About 20 Students)	2173	2400	90.54%	Very Feasible
Average	88.63%		Very Feasible	

Based on Table 1 shows that the average of subject validation and responden results is 88.63% with very feasible criteria. That means SBMT can assist students understanding the course of Distribution and Transmission System with Maneuver Power distribution network.

The qualitative data which this data used for product revision can be seen in Table 2.

Table 2. Qualitative Data of Implementation Result

Subject	Opinion & Suggestion	Evaluation
Media Expert	SBMT products are feasible. But the color on the trainer is less clear, the lack of tasks on the jobsheets, there is no answer key to the lecturers guide	Clarifying the color of the trainer, adding tasks on the jobsheets and adding the answer key for the lecturers guide
Matter Expert	SBMT product can be used for Distribution and Transmission learning. But there is no manual book that explain specifications trainer, how to maintenance trainer, how to install trainer, safety and health. And also trainer can accommodate quick direct circuit disturbance	Complete the trainer with manual book and revise to make trainer safer
Responden (About 20 Students)	SBMT products are interesting, project corresponding with real field conditions. Using SBMT, respondents admitted to be more understanding about sectionalizer	Adding more complex tasks and materials

Based on Table 2, it can be seen there are some opinions and suggestions from subject validation and subject implementation. The opinions and suggestions becomes an input for the improvement of SBMT development so SBMT products are better.

Shelton et al (2008:42) says there are three segments that must be analyzed such as the learner, learning and media (online) to deliver the instructional materials [5]. The design step includes a step in which activities identify objectives, determine the learning strategy that will be used to achieve those objectives, determine how the objectives be judged and choosing the assessment form⁽⁴⁾. Successful achievement of sectionalizer based microcontroller trainer can be seen from the success of trainer developed achieves the goal according to the analysis step and design step that has been specified.

CONCLUSIONS:

Based on the results of research and analysis of data that has been implemented concluded that:

1. The development done successfully develop sectionalizer based microcontroller trainer which completely with jobsheets and handouts
2. The products of this development were very feasible with average is 88.63%. This is evidenced from the results of quantitative data validation and implementation result, validation done by media expert is 82.85% very feasible, while done by matter expert is 92.50% very feasible, and implementation in a field test done by about 20 students is 90.54% very feasible.
3. From the results of percentage obtained, the trainer, jobsheets and handouts feasible to be used as a learning media on the course of Distribution and Transmission System in Department of Electrical Engineering, Universitas Negeri Malang, Indonesia.

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